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EXAMINER

LU, KUEN S

ART UNIT PAPER NUMBER

2167

DATE MAILED: 07/01/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/775,766

Applicant(s)

HINSHAW ET AL.

Examiner

Kuen S Lu

Art Unit

2167

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 10 February 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-63 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-63 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>#1 2/3/2005</u> | 6) <input type="checkbox"/> Other: _____ |

DEAILED ACTION

Claim Rejections - 35 USC § 101

1. 35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

2. Claims 1-32 and 33-63 are rejected under 35 U.S.C. 101 because they are inoperative and therefore lack utility by without specifying what methods or systems to implement. The Examiner would suggest all claims starting with "A method", "The method", "A system" and "The system" be amended to "A computer-implemented method", "The computer-implemented method", "A computer-implemented system" and "The computer-implemented system", respectively.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

4. Claims 1-18, 24-49 and 55-63 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cochrane et al. (U.S. Publication 2004/0128289, hereafter

“Cochrane”) and further in view of LeCrone et al. (U.S. Patent 6,308,284, hereafter “LeCrone”).

As per claims 1 and 33, Cochrane teaches “maintaining materialized views of a data source in a system of multiple storage units and a host controller” (See Fig. 1 and Page 2, [019] wherein Cochrane’s materialized views and databases are maintained in an architecture includes multiple processors and storage units is equivalent to the Applicant’s maintaining materialized views of a data source in a system of multiple storage units and a host controller).

Cochrane does not specifically teach the storage units featuring “distributing control of portions of a materialized view to respective storage units, such that each storage unit controls and stores a portion of the materialized view corresponding to an associated portion of the data source”, although Cochrane teaches each storage stores a portion of the materialized view corresponding to an associated portion of the data source at Page 2, [0019] where materialized views are incrementally maintained in the storage units.

However, LeCrone teaches distributing control of portions of a database to respective storage units, such that each storage unit controls and stores a portion of the database corresponding to an associated portion of the data source at Figs. 1 and 10, col. 5, line 64 – col. 6, line 3 and col. 11, lines 4-15 wherein LeCrone’s local database is mirrored and distributed to remote storage units for storage where remote storage controllers control the read and write operations is equivalent to the Applicant’s distributing control of portions of a database to respective storage units, such that each storage unit

controls and stores a portion of the database corresponding to an associated portion of the data source).

It would have been obvious to one having ordinary skill in the art at the time of the applicant's invention was made to combine LeCrone's teaching into Cochrane's reference by distributing data storage and storage control of materialized view to remote storage units because both references are devoted to dataset storage where data security and query efficiency are critical to the success of a dataset operation, and the combined teaching would have enabled a data warehouse system to perform query at a significant reduced time and execute the complex process of warehouse data change efficiently while storage for both databases and materialized views are maintained in redundant and secure storage environment.

The combined teaching of LeCrone and Cochrane references further teaches "using the respective storage unit, independent of the host controller, maintaining the corresponding portion of the materialized view" (See LeCrone: Figs. 1 and 10, col. 5, line 64 – col. 6, line 3 and col. 11, lines 4-15 where database data are distributed to store on storage devices independent of specific hosts, and Cochrane: Fig. 1 and Page 2, [019] wherein Cochrane's materialized views and databases are maintained in an architecture includes multiple processors and storage units).

As per claims 2 and 34, Cochrane further teaches "maintaining the corresponding portion of the materialized view further comprises: executing a set of instructions associated with the materialized view" (See Pages 1-2, [0005] and [0025] wherein

Cochrane's aggregate functions are provided to perform immediate incremental maintenance of materialized views is equivalent to the Applicant's maintaining the corresponding portion of the materialized view further comprises: executing a set of instructions associated with the materialized view).

As per claims 3 and 35, LeCrone further teaches "sending the set of instructions from the host controller to the storage unit" (See Fig. 10, elements 119 and col. 11, lines 4-15 wherein LeCrone's write request is transferred to remote controllers at the remote storage units is equivalent to the Applicant's sending the set of instructions from the host controller to the storage unit).

As per claims 4 and 36, LeCrone does not specifically teach "the set of instructions is a set of compiled instructions".

However, LeCrone teaches sending write request to the remote controller of the remote storage units as previously described in claims 3 and 35 rejection.

It would have been obvious to one having ordinary skill in the art at the time of the applicant's invention was made to combine LeCrone's teaching into Cochrane's by compiling data request instructions before transferring from the local system to the controllers of the remote storage units because utilizing compiled instruction for performing data operation request would have further increased the i/o performance of storage units because of saving the steps of compiling i/o instructions.

As per claims 5 and 37, LeCrone further teaches "caching the set of instructions at the storage unit" (See col. 7, lines 20-33 wherein LeCrone's system memory is implemented on the bus of the storage units suggests the teaching of caching the set of instructions at the storage unit).

As per claims 6 and 38, neither of Cochrane and LeCrone references specifically teaches "the set of instructions is a set of not compiled instructions and the storage unit selects a subset of instructions for execution", although Cochrane teaches executing a set of instructions associated with the materialized view" at Pages 1-2, [0005] and [0025] where aggregate functions are provided to perform immediate incremental maintenance of materialized views as previously described in the claims 2 and 34 rejection.

However, LeCrone suggests the teaching of a set of instructions is a set of compiled instructions as previously described in claims 4 and 36 rejections.

It would have been obvious to one having ordinary skill in the art at the time of the applicant's invention was made to combine LeCrone's teaching into Cochrane's by compiling data request instructions before transferring from the local system to the controllers of the remote storage units and further enabling emote units to flexibly select a subset from a set of compiled instructions because flexibly utilizing subsets of compiled instruction set for performing data operation request would have further increased the i/o performance of storage units because of saving the steps of compiling i/o instructions while specific subset of the instruction set selected and executed.

As per claims 7 and 39, Cochrane further teaches “the set of instructions is based on a data schema” (See Pages 1-2, [0005] and [0025] wherein Cochrane’s aggregate functions are compiled and performed on materialized views in the incremental update operation is based on materialized views built on the basis of base relations where base relations are schema based is equivalent to the Applicant’s the set of instructions is based on a data schema).

As per claims 8 and 40, Cochrane further teaches “the set of instructions is used to propagate rows inserted into the data source to the materialized view” (See Pages 1-2, [0005] and [0025] wherein Cochrane’s aggregate functions are compiled and performed on materialized views in the incremental update operation is equivalent to the Applicant’s the set of instructions is used to propagate rows inserted into the data source to the materialized view).

As per claims 9 and 41, Cochrane further teaches “in response to an instruction to insert new data into the data source, the new data on disk without inserting it into the materialized view” (See Pages 2-3, [0027] wherein Cochrane’s records of base tables are updated, inserted and deleted while the apply phase execution of materialized views is performed separately by the aggregate functions based on automated summary tables is equivalent to the Applicant’s in response to an instruction to insert new data into the data source, the new data on disk without inserting it into the materialized view).

As per claim 10, Cochrane further teaches “the new data is shared among multiple materialized views and the multiple materialized views are maintained by one step of storing the new data on disk” (See Fig. 5 and Page 1, [0005] and Page 4, [0037] wherein Cochrane’s automatic summary tables are maintained for aggregate function to incrementally update materialized views where each aggregate function is a function of an atomic step is equivalent to the Applicant’s the new data is shared among multiple materialized views and the multiple materialized views are maintained by one step of storing the new data on disk).

As per claims 11 and 42, Cochrane further teaches “tagging the new data as private to the materialized view” (See Figs. 5A-5B and Page 4, [0038] wherein Cochrane’s predicates of logic differentiate automatic summary table records to be updated, deleted and inserted such that applying phase can operate accordingly is equivalent to the Applicant’s tagging the new data as private to the materialized view).

As per claims 12 and 43, Cochrane further teaches “transforming, before storing the new data, new data into a format appropriate for the materialized view” (See Figs. 5A-5B and Page 4, [0037]-[0038] wherein Cochrane’s new data are converted and stored into automatic summary table before being incrementally updated to the materialized views is equivalent to the Applicant’s transforming, before storing the new data, new data into a format appropriate for the materialized view).

As per claims 13 and 44, the combined teaching of Cochrane and LeCrone references further teaches the following:

“sorting the new data in response to an instruction to present the materialized view”

(See Cochrane: Fig. 1, elements 12-16 and Page 2, [0020] where records of materialized views are queried and retrieved, and LeCrone: Figs. 6-7 and col. 8, lines 35-38 where control block of subsystems are sorted); and

“merging the new data with data from the materialized view as it is streamed to output”

(See Cochrane: Fig. 2 and Pages 1-2, [0005], [0020], [0025]-[0026] wherein Cochrane's materialized view records insertion, query, aggregate and retrieval functions are performed and outputted suggests the teaching of merging the new data with data from the materialized view as it is streamed to output).

As per claims 14 and 45, the combined teaching of Cochrane and LeCrone references further teaches the following:

“transforming the new data into a format appropriate for the materialized view in response to an instruction to present the materialized view” (See Cochrane: Figs. 5A-5B and Page 4, [0037]-[0038] wherein Cochrane's new data are converted and stored into automatic summary table before being incrementally updated to the materialized views is equivalent to the Applicant's transforming the new data into a format appropriate for the materialized view in response to an instruction to present the materialized view);
and

“merging the new data with data from the materialized view as it is streamed to output” (See Cochrane: Fig. 2 and Pages 1-2, [0005], [0020], [0025]-[0026] wherein Cochrane’s materialized view records insertion, query, aggregate and retrieval functions are performed and outputted suggests the teaching of merging the new data with data from the materialized view as it is streamed to output).

As per claims 15 and 46, the combined teaching of Cochrane and LeCrone references further teaches “the step of transforming the new data is performed in storage unit hardware” (See LeCrone: Fig. 10, elements 119 and col. 11, lines 4-15 wherein LeCrone’s write request is transferred to remote controllers at the remote storage units is equivalent to the Applicant’s the step of transforming the new data is performed in storage unit hardware).

As per claims 16 and 47, the combined teaching of Cochrane and LeCrone references further teaches “sorting the new data according to a format of the materialized view” (See Cochrane: Fig. 1, elements 12-16, Figs. 5A-5B and Pages 2, 4, [0020] and [0037]-[0038] where records of materialized views are queried and retrieved, and new data are converted and stored into automatic summary table before being incrementally updated to the materialized views, and further at LeCrone: Figs. 6-7 and col. 8, lines 35-38 where control block of subsystems are sorted).

As per claims 17 and 48, the combined teaching of Cochrane and LeCrone references further teaches “updating the materialized view during a time of low activity on the storage unit” (See Cochrane: Page 1, [0003] wherein Cochrane’s materialized views change may take place immediately after the change of base tables or may be deferred which suggests the teaching of updating the materialized view during a time of low activity on the storage unit).

As per claims 18 and 49, the combined teaching of Cochrane and LeCrone references further teaches “the data source is a base table” (See Cochrane: Page 2, [0011] and [0024] wherein Cochrane’s base tables is the underlying data source for the materialized view).

As per claims 24 and 55, it is well known to an ordinary skilled ion the art when records of a base relation in a database are deleted without removing content from the storage until a database re-org operation is performed suggests the teaching of “indicating deleted data as deleted without removing it from the materialized view”.

As per claims 25 and 56, it is well known to an ordinary skilled ion the art that archive logs are maintained for recording status of every transaction performed on database such that database can be rolled back or forward should occasions require and data on timing, record and transaction involved are stored in the log teaches “wherein the deleted data is data before an indicated time, and the step of indicating the deleted data

further comprises: storing the indicated time" and "in response to an instruction to present the materialized view, removing records with a time indication less than the stored indicated time as data from the materialized view is streamed to output".

As per claims 26 and 57, the combined teaching of Cochrane and LeCrone references further teaches "deleting data from the materialized view corresponding to data source records indicated for deletion as data is streamed to output in response to an instruction to present the materialized view" (See Cochrane: Page 3, [0031] wherein Cochrane's automatic summary table groups records for being deleted from the materialized view alone and from both the view and base relations differently suggests the teaching of deleting data from the materialized view corresponding to data source records indicated for deletion as data is streamed to output in response to an instruction to present the materialized view).

As per claims 27 and 58, the combined teaching of Cochrane and LeCrone references further teaches "physically deleting the indicated deleted data from the materialized view at a time of low activity on the storage unit" (See Cochrane: Page 1, [0003] wherein Cochrane's materialized views change may take place immediately after the change of base tables or may be deferred which suggests the teaching of physically deleting the indicated deleted data from the materialized view at a time of low activity on the storage unit).

As per claims 28 and 59, it is well known to an ordinary skilled ion the art that archive logs are maintained for recording status of every transaction performed on database such that database can be rolled back or forward should occasions require and data on timing, record and transaction involved, including the transaction ID assigned, are stored in the log teaches "assigning a transaction ID to the materialized view".

As per claims 29 and 60, it is well known to an ordinary skilled ion the art that archive logs are maintained for recording status of every transaction performed on database such that database can be rolled back or forward should occasions require and data on timing, record and transaction involved are stored in the log teaches, noting transaction ID and timing are determined to decide the range of database recovery, "the transaction ID of the materialized view represents a point past which transactions cannot be rolled back".

As per claims 30 and 61, it is well known to an ordinary skilled ion the art that materialized views are created from base relations of a database, for example, facts of daily sales in data warehouse are created based on the summary information of tables from a database for business transaction, suggests the teaching of "creating the materialized view from the data source using one or more of base relationships".

As per claims 31 and 62, it is well known to an ordinary skilled ion the art that materialized views are refreshed periodically to refresh the changes taking place in the

base relations, for example, facts of daily sales in data warehouse are refreshed nightly based on the summary information of tables from a database for business transaction, suggests the teaching of "the base relationships is further modified by modifiers".

As per claims 32 and 63, it is well known to an ordinary skilled ion the art that views can be created from other views or base relations, for example, a department store company's toy sale amount is created based on the summary of toy sale by all department stores which is further created on the basis of summary information of every toy sale by all department stores, suggests the teaching of "storing intermediate views if the materialized view involves more than one base relationship".

3. Claims 19-23 and 50-54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cochrane et al. (U.S. Publication 2004/0128289, hereafter "Cochrane"), in view of LeCrone et al. (U.S. Patent 6,308,284, hereafter "LeCrone"), as applied to claims 1 and 33 above, and further in view of Okada et al. (U.S. Publication 2002/0040413, hereafter "Okada").

As per claims 19 and 50, the combined teaching of Cochrane and LeCrone references teaches maintaining materialized views in distributed storage units as previously described in claims 1 and 33 rejections.

The combined teaching of LeCrone and Cochrane references does not specifically teach “compressing the materialized view”, although Cochrane teaches storing materialized view records.

However, Okada teaches compressing the database record (See Pages 5-6, [0009] where warehouse data cubes are compressed).

It would have been obvious to one having ordinary skill in the art at the time of the applicant's invention was made to combine Okada' teaching with LeCrone and Cochrane references by compressing materialized views because all references are directed to data storage and management, and the further combined teaching of the references would have enabled a data warehouse system to efficiently store data in a highly compressed structure requiring a much smaller storage capacity while maintaining distributed and redundant storage of data for improving data security and system performance.

As per claims 20 and 51, the combined teaching of Okada, Cochrane and LeCrone references further teaches the following:

“compressing the materialized view further comprises: compressing a record before a write operation” (See Okada: Fig. 6, steps S403-S404, S406, S408 and Page 7, [0196]-[0210] wherein Okada's data records are compressed before being stored and, restored and transferred after being read out is equivalent to the Applicant's compressing the materialized view further comprises: compressing a record before a write operation);
and

“decompressing a record after a read operation” (See Okada: Fig. 6, steps S403-S404, S406, S408 and Page 7, [0196]-[0210] wherein Okada’s data records are compressed before being stored and, restored and transferred after being read out is equivalent to the Applicant’s decompressing a record after a read operation).

As per claims 21 and 52, the combined teaching of Okada, Cochrane and LeCrone references further teaches compressing the materialized view (See).

The combined teaching of the three references does not specifically teach “assigning a smaller data type to a column containing data of a larger data type, the data fitting within the smaller data type”.

However, it is well known to an ordinary skilled in the art to utilize a smaller data type to a column containing data of a larger data type, the data fitting within the smaller data type for compressing data to save storage, for example, a data type of number(32) will be utilized to store a number originally stored in number(132) as a preliminary step of data compression should the content fit in the smaller data type number(32).

It would have been obvious to one having ordinary skill in the art at the time of the applicant’s invention was made to further combine Okada’ teaching with LeCrone and Cochrane by assigning a smaller data type to a column containing data of a larger data type, the data fitting within the smaller data type because the combined teaching would have further compress data to further reduce the storage capacity required.

As per claims 22 and 53, the combined teaching of Okada, Cochrane and LeCrone references further teaches "removing a Record ID column when there are no duplicates in data in the materialized view" (See Okada: Fig. 15 and Page 1, [0009]-[0010] wherein Okada's identifiable record segments are packed without specifically recording identifications and record position of write data after being compressed is identified suggests the teaching of removing a Record ID column when there are no duplicates in data in the materialized view).

As per claims 23 and 54, the combined teaching of Okada, Cochrane and LeCrone references further teaches the following:

"removing a Transaction ID column when there is no change in data records before an indicated time" (See Okada: Fig. 15 and Page 1, [0009]-[0010] wherein Okada's identifiable record segments are packed without specifically recording identifications and record position of write data after being compressed is identified suggests the teaching of removing a Transaction ID column when there is no change in data records before an indicated time); and

"recording the indicated time" (See Okada: Fig. 31, Page 1, [0014] and Page 13, [0345] wherein Okada's data segments are compressed in time-series suggests the teaching of recording the indicated time).

5. The prior art made of record

A. U.S. Publication 2004/0128289

B. U.S. Patent 6,308,284

C. U.S. Publication 2002/0040413

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

D. U.S. Publication 2003/0126143

E. U.S. Patent 5,842,207

F. U.S. Patent 6,745,207

Conclusions

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kuen S. Lu whose telephone number is (571) 272-4114. The examiner can normally be reached on Monday-Friday (8:30 am-5:30 pm). If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John E Breene can be reached on (571) 272-4107. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for Page 13 published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 886-217-9197 (toll-free).

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Kuen S. Lu



Patent Examiner

June 24, 2005



Mohammad Ali

Primary Examiner

June 24, 2005